EXHIBIT 1

U.S. Department of Justice

United States Attorney
Southern District of New York

The Silvio J. Mollo Building
One Saint Andrew's Plaza
New York, New York 10007

October 30, 2023

VIA USAfx
Brian Klein
c/o Sam Talkin
Waymaker Law
515 Flower Street #3500
Los Angeles, CA 90071

Re: *United States v. Avraham Eisenberg*, 23 Cr. 10 (AS)

Dear Counsel:

Pursuant to the Court's scheduling order, the Government hereby provides notice that it may call Kapil Jain and Dr. David Mordecai as witnesses in the trial of the above-referenced matter. Enclosed is a disclosure made pursuant to Federal Rule of Criminal Procedure 16(a)(1)(G) stating the anticipated opinions of Kapil Jain and Dr. David Mordecai and the bases and reasons for them. The Government reserves the right to supplement and/or amend these notices and will do so promptly pursuant to the requirements of Rules 16(a)(1)(G)(vi) and 16(c).

We also note that, during trial, the Government may call Joel DeCapua, a Special Agent with the Federal Bureau of Investigation, as a witness to provide testimony about, and introduce charts summarizing, the flow of cryptocurrency between accounts and wallets relevant to the charges alleged in the Indictment. This testimony may include identifying accounts the defendant used and describing the flow of funds through those accounts. The Government does not believe this type of testimony would constitute expert testimony pursuant to Federal Rule of Evidence 702. Nonetheless, the Government is providing a copy of Special Agent DeCapua's *curriculum vitae*, which is enclosed.

Please contact us with any questions.

Very truly yours,

DAMIAN WILLIAMS
United States Attorney

by: /s/ *Thomas Burnett*
Thomas Burnett
Peter Davis

Assistant United States Attorneys

Tian Huang
Special Assistant United States Attorney

Enclosure

Expert Disclosure – Kapil Jain
(October 30, 2023)

Kapil Jain is currently the founder and CEO of AutoVaR, a privately-funded research and development laboratory that collaborates with faculty from Stanford University ("Stanford"). Mr. Jain specializes in complex financial markets, instruments, market microstructure, and trading strategies. He will be called to testify regarding the economic features of certain cryptocurrencies and cryptocurrency-related derivatives, as further described below.

A. Qualifications and Prior Testimony

Mr. Jain's qualifications, including a list of all cases in the last four years in which he testified as an expert are contained in his curriculum vitae, attached hereto as Appendix A.

Mr. Jain is an independent expert who will be supported by an economic consulting firm called The Brattle Group in this matter. The Brattle Group and the Government have entered a contract for its work leading up to trial and any testimony from Mr. Jain. He is being compensated at a rate of $995 per hour.

B. Anticipated Opinions

The Government expects that Mr. Jain may testify about the cryptocurrency market and the use of stablecoins, the commodities market, the commodities derivatives market, and offer his expert opinion about the perpetual futures contracts ("Perpetuals") offered on Mango Markets.

1. Mr. Jain may define and provide a general overview of cryptocurrencies and the blockchain, including by offering examples of cryptocurrencies and explaining how they are transacted on the blockchain and on cryptocurrency exchanges. Mr. Jain's testimony concerning this topic will be based on his independent and academic research and industry experience in the field of cryptocurrency.

2. Mr. Jain may define and provide a general overview of the economic features of and uses for stablecoins in the cryptocurrency market. This may include a description of the economic features of and uses for USD Coin ("USDC"). Mr. Jain may explain that USDC is a stablecoin that is different from the U.S. dollar (including in that it is issued by a private entity), but is designed to closely match the value of U.S. dollar and explain the economics of how this is supposed to operate. Mr. Jain may also explain that USDC is traded on multiple cryptocurrency exchanges. Mr. Jain's testimony concerning this topic will be based on his independent and academic research and experience in the field of cryptocurrency.

3. Mr. Jain may explain that cryptocurrency markets, including Mango Markets, involve financial products and trading tools that are common in many types of commodities and foreign-exchange markets. Among other things, Mr. Jain may explain the concepts and economics of derivatives contracts, futures contracts, spot exchanges, and swaps in commodities and foreign-exchange markets, and explain that similar products and concepts are often available in cryptocurrency markets, including Mango Markets. As described further below, Mr. Jain may also testify about the idea of trading on margin and explain how that is common in both cryptocurrency markets and also commodity and foreign-exchange markets. Mr. Jain's testimony concerning this

topic will be based on his research and experience in the field of commodity derivatives, as well as prior employment experience trading derivative products.

4. Mr. Jain may testify that financial institutions and cryptocurrency exchanges offer futures contracts and other derivatives based on cryptocurrencies, including futures contracts and other derivatives based on USDC. Mr. Jain's testimony concerning this topic will be based on his independent and academic research and experience in the field of commodity derivatives.

5. Mr. Jain may describe the cryptocurrency trading and investing options available to users of Mango Markets in October 2022, as well as the economic features of those trading and investing options. This may include an analysis of the characteristics, pricing, and economic features of a type of product available to users of Mango Markets called a perpetual futures contract ("Perpetuals"), described in greater detail in the paragraph below. This may also include an analysis of the ability of users of Mango Markets to borrow and lend cryptocurrency on the platform, also described in greater detail below. As part of his testimony, Mr. Jain may describe the Mango Market user interface through which customers traded cryptocurrency and cryptocurrency derivatives. Mr. Jain's testimony concerning this topic will be based on his review of explanatory documents provided on Mango Market's website and other documents produced by Mango Markets, as well as his research and experience in the field of cryptocurrency, where instruments of this sort are commonly available.

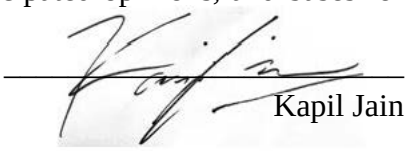
6. As noted above, with respect to Perpetuals, Mr. Jain may offer an analysis of the characteristics, pricing, and economic features of Perpetuals available on Mango Markets in or about October 2022. Mr. Jain may explain that Mango Markets allowed users to trade Perpetuals based on different cryptocurrency pairs, including a pairing based on the relative value of USDC and MNGO ("MNGO-USDC Perpetuals"). Mr. Jain may explain that MNGO-USDC Perpetuals transfer the economic risk between the parties to those Perpetuals about how the value of MNGO and USDC may change relative to one another in the future, without involving the actual exchange of USDC and MNGO between the counterparties. Mr. Jain may further explain that, because there is no single, centralized exchange for USDC and MNGO, the relative value of those cryptocurrencies for pricing MNGO-USDC Perpetuals needs to be calculated by some form of index or measuring tool, which in the context of Mango Markets is known as an oracle (the "Oracle"). Mr. Jain may further explain that another economic characteristic of MNGO-USDC Perpetuals is the "funding" feature, which is a periodic, automatic transfer of USDC between parties to the MNGO-USDC perpetual depending on the difference between the market rate at which Perpetuals are trading and the oracle price. Mr. Jain's testimony will be based on his review of Mango Markets documents, his research and experience in the field of cryptocurrency, and his research and experience in the field of derivatives trading. Mr. Jain may also explain that Perpetuals are a type of instrument commonly available on cryptocurrency exchanges.

7. As noted above, with respect to borrowing and lending, Mr. Jain may offer an analysis of the characteristics and economic features of the borrowing and lending functions available on Mango Markets. Mr. Jain may describe the economic concept of margin trading and that Mango Markets allowed users to lend and borrow cryptocurrency on the platform, including for such trading. Mr. Jain may further explain that borrowing and lending on Mango Markets involved an exchange of interest payments based on floating interest rates. He may also explain the economic incentives that those floating interest rates created for borrowing and lending on the

platform. Mr. Jain may also explain the economic rationale for why, in markets with margin trading, it is common for there to be limits on the extent to which traders can borrow. Mr. Jain may explain that, consistent with other markets with margin trading, Mango Markets had limits on borrowing, based on the collateral available in a user's portfolio, as well as the economic implications of such limits for users of the platform who may be considering whether to borrow or lend. Mr. Jain's testimony will be based on his review of Mango Markets documents, his research and experience in the field of cryptocurrency (where margin trading is common), and his research and experience in the field of derivatives trading.

C. **Approval and Signature**

I hereby approve the disclosure of my qualifications, anticipated opinions, and bases for such opinions, as set forth above.



Kapil Jain

Appendix A

Kapil K. Jain

kkjain@stanfordalumni.org (917) 719-0915

Employment Experience

AutoVaR Corporation (Palo Alto, CA) June 2020- current, Founder & CEO
- Run a research oriented startup, focused on financial and risk management applications

nCent Laboratories (Palo Alto, CA) 2017- May 2020, Founder & CEO
- Run a research oriented blockchain startup, raised $10.5MM in funding from leading venture investors and angels
- Use cases: Decentralized finance, identity verification and consumer referrals for customer acquisition and recruiting

Stanford University (Palo Alto, CA) 2013-2017, Director
- Founding Director of the Mathematical and Computational Finance Program within Stanford School of Engineering: 4% admission and 100% student placement rate
- Taught popular project course, CME 238: Artificial Intelligence in Financial Technology which included projects and methods for building machine learning models using financial data, including mining event driven equity data and SEC filings
- Co-founder of the Advanced Financial Technologies Laboratory, and organizer of the annual Stanford Artificial Intelligence in Financial Technology conference

Citigroup Global Markets, Inc (New York, NY) 2010-2012, Director
- Business owner of Equity Principal Strategies, a $6bn internal proprietary trading desk with 35 people trading Statistical Arbitrage, Event Driven, Macro, and Equity Long Short strategies.
- Managed an over $2.5 billion book of Statistical Arbitrage, Event Driven and Macro strategies, with a team of 5
- Developed machine learning models that drove trading across markets, including securities linked to events such as 13F and 13D filings, mergers, event activity in options markets, and regulatory announcements
- Drafted and delivered C-level proposals and strategy overviews as the business and P&L owner

Perry Capital (New York, NY) 2006-2009, Fund Manager
- Modeled, traded and risk managed in excess of $20 billion notional portfolio including equity options
- Managed staff of 8 programmers, 3 quantitative analysts; executed complex technical projects

D.E. Shaw & Co., Inc. (New York, NY) 2002-2004 Quantitative Researcher
- Modeled, traded and risk managed more than $1 billion notional of securities including equity options
- Developed machine learning models that explained volatility, event, interest and credit risk of various structured products; incorporated results into a proprietary trading algorithm
- Created the firm's first structured credit risk and trading model, including for housing related bonds, incorporating market data, intelligence and research from academia

Microsoft Corporation (Redmond, WA) 2001-2002 Program Manager
- Researched, designed, and implemented the automatic updates/ "Drizzle" feature for Excel
- Wrote specification for porting Instant Messenger for Windows to the Apple Cocoa platform

Education

Stanford University (Palo Alto, CA)
● Masters of Science, Financial Mathematics, 2006

Dartmouth College (Hanover, NH)
● Bachelor of Science, Engineering and Mathematics, 2002

Expert and Advisory Work

● Expert testimony given since 2019
  - [Ongoing] Commodity Futures Trading Commission v. LJM Funds Management, Ltd. et al N.D.Ill. 1:21-cv-02863: provided expert reports and deposition testimony
● Other expert consulting services on various financial markets and litigation matters. Select matters include:
  - Securities and Exchange Commission (SEC): provided expert services and conducted detailed analysis in a litigation involving one of the largest and most complex multinational bank credit derivatives portfolios
  - Federal Trade Commission (FTC): provided expert services in an online options trading education scheme resulting in more than a $5.4 million settlement involving more than 31,000 consumers
  - Department of Justice (DOJ): provided expert services on a complex litigation involving novel investment and derivatives contracts on an unregistered, offshore exchange, resulting in a favorable settlement
● Regular invited speaker at prominent academic, corporate, and policy seminars including: Columbia, IIT, UCSD, IMF-World Bank, Asian Banker, Fannie Mae/ Freddie Mac, FHFA, CFPB, BBVA, State Street, Blackrock, PIMCO, RBS, Prudential, Morgan Stanley, SAP, Nvidia, AIG and other private hedge funds and technology companies
● Advised over 15 young, high-growth startup companies
● Mentor and Advisor for the POINT Foundation, the national LGBTQ scholarship fund

Blog

● KK Jain (@kk_ncnt) | HackerNoon (last post on September 17, 2018, active from June 25, 2018)

Expert Disclosure – Dr. David K.A. Mordecai
(October 30, 2023)

Dr. Mordecai is President and Co-Founder of Risk Economics, Inc. (Risk Economics) and Adjunct Professor of Econometrics and Statistics at the University of Chicago Booth School of Business. Dr. Mordecai is also a Visiting Scholar at Courant Institute of Mathematical Sciences New York University (NYU), where he co-advises research activities at RiskEcon® Lab for Decision Metrics (RiskEcon® Lab).

The Government expects to call Dr. Mordecai to testify regarding economic concepts and data analysis, as described below.

A. Qualifications and Prior Testimony

Dr. Mordecai has approximately forty years of experience across industry and financial markets, particularly within banking, structured finance, trading, and reinsurance. Dr. Mordecai also has extensive experience with complex issues related to finance, economics, and industry and market custom and practice within securities and derivatives markets. His direct experience and expertise extends to both cryptographic instruments and their underlying distributed ledger technologies, *e.g.*, blockchain transactions.

Dr. Mordecai is also Co-Managing Member and Co-Founder of Numerati Partners LLC, in which capacity he has led the technical review of blockchain and digital ledger technology offerings for a consortium of insurers and reinsurers. Dr. Mordecai is also Visiting Scholar at Courant Institute of Mathematical Sciences NYU, co-advising research activities at RiskEcon® Lab, including research regarding cryptographic instruments and protocols. Dr. Mordecai has served as Scientist-in-Residence for over ten years at FinTech Innovation Lab, an industry-led financial technology accelerator co-led by The Partnership for New York City, in coordination with a consortium of banks, insurers, reinsurers, venture capital, private equity and asset management firms. Dr. Mordecai is the Science Board Advisor to AlphaPoint, a full-stack software and financial technology solutions vendor for institutional digital asset and cryptocurrency operators globally for over 150 exchanges, brokerages and other market participants including the Chicago Mercantile Exchange (CME), and across 35 countries. Dr. Mordecai was also an active member of the Investment Advisory Committee of the New York Mercantile Exchange (NYMEX) for several years prior to the acquisition by the CME. He has been an invited participant on industry panels to discuss risk management of blockchain architectures and protocols.

Dr. Mordecai's qualifications, a list of publications he has authored, and a list of all cases in which he has testified as an expert during the past four years are contained in his curriculum vitae, which is attached as Appendix A.

Dr. Mordecai is compensated for his time at the rate of $1,125 per hour. His work is being supported by personnel at Risk Economics, Inc., as well as the economic consulting firm Analysis Group, Inc., who have performed research and analysis under his direct oversight. Analysis Group and Risk Economics, Inc. are being compensated separately for their work on this matter. Neither Dr. Mordecai's compensation, nor the compensation of either Risk Economics, Inc. or Analysis Group, Inc. are contingent upon Dr. Mordecai's testimony or the outcome of this matter.

B. Summary of Materials Reviewed

Dr. Mordecai has received and reviewed materials produced in discovery during this case, including materials listed in Appendix B. His testimony will be based on his review of those materials and other materials from this case, his professional experience and research, and his familiarity with relevant research from his teaching, career, and preparation for this case.

C. Anticipated Opinions

The Government anticipates that Dr. Mordecai may offer the following testimony:

1. Dr. Mordecai may define and explain terms and concepts relevant to his testimony, including: the concept of cryptographic digital instruments commonly referred to as cryptocurrencies; the concept and use of cryptocurrency wallets; the structure and function of cryptocurrency exchanges; and the concept and economics of perpetual futures contracts, wash trades, collateral lending, asset liquidation, and market liquidity and asset price discovery.

2. Dr. Mordecai may explain the size, structure, and economics of the MNGO-USDC Perpetuals positions that Mr. Eisenberg allegedly created on or around October 2022 (the "Long Perpetuals Position" and the "Short Perpetuals Position," respectively). Based on his review of Mango Markets data, Dr. Mordecai may explain that the Long and Short Perpetuals Positions were opposite one another, identify the size of the positions (in excess of 488 million MNGO), and identify the price of the positions (approximately 0.0382 USDC/MNGO). Dr. Mordecai may also explain the economics of the positions: namely, that the value of the account with the Short Perpetuals Position would increase if the value of MNGO relative to USDC fell below 0.0382 USDC/MNGO, and that the value of the account with the Long Perpetuals Position would increase if the value of MNGO to USDC increased above 0.0382 USDC/MNGO.

3. Dr. Mordecai may testify about the economic implications if Mr. Eisenberg held both the Long and Short Perpetuals Positions. Specifically, Dr. Mordecai may explain that, if Mr. Eisenberg held both positions, he effectively would have had had no net economic exposure to the price of the underlying asset, *i.e.*, any gain to the long position would have been exactly offset by a loss to the short position, and vice versa. Dr. Mordecai may further explain that where the same party holds both sides of a position, that is referred to in markets as a "wash trade."

4. Dr. Mordecai may explain that entering long and short positions of the same perpetual futures contract (*i.e.*, wash trading) is not economically rational as a way to gain exposure to the underlying cryptocurrencies (MNGO and USDC). Dr. Mordecai may explain that with the all-in cost incorporating transactions fees, the expected return of this perpetual futures trade is strictly negative.

5. Dr. Mordecai may testify about the historical trading patterns of prices and corresponding observed volume of orders for MNGO-USDC Perpetuals on Mango Markets in the months preceding October 2022, based on data from Mango Markets. Dr. Mordecai may present analyses comparing historical trading patterns of MNGO-USDC Perpetuals on Mango Markets in the months preceding October 2022 with Mr. Eisenberg's alleged MNGO-USDC Perpetuals trades in October 2022. Dr. Mordecai may testify that the notional size of Mr. Eisenberg's MNGO-USDC Perpetuals positions (both long and short) were magnitudes above the historical open interest in these Perpetuals.

6. Dr. Mordecai may explain that the size and price of Mr. Eisenberg's alleged MNGO-USDC Perpetuals trades all but ensured that he would be the counterparty to his own trades (*i.e.*, Mr. Eisenberg would be able to sell these futures contracts only to himself), thereby obtaining a large leveraged exposure to the relative pricing of MNGO versus USDC tokens. In other words, there likely would not have been a market for the Long and Short Perpetual Positions at their size and price, but for Mr. Eisenberg's wash trade.

7. Dr. Mordecai may explain that Mango Markets used an algorithm called an "oracle" from Switchboard to calculate the relative value of two cryptocurrencies by looking at the exchange rate of those cryptocurrencies on various relevant sources of cryptocurrency prices and order flows. Dr. Mordecai may further explain that when the oracle price changes for a specific cryptocurrency pairing, the Perpetuals price based on that pairing also changes on Mango Markets. Dr. Mordecai may testify that specifically for the MNGO-USDC Perpetuals price, the relevant sources for this oracle were FTX, AscendEx, and Jupiter Aggregator.

8. Dr. Mordecai may testify about data analyses showing that Mr. Eisenberg's alleged trading on or about October 11, 2022 drastically and temporarily increased the relative value of MNGO and USDC, as well as the price of MNGO-USDC Perpetuals on Mango Markets. He may also testify that the relative value of MNGO and USDC, and the price of MNGO-USDC Perpetuals, would not have increased as they did absent Mr. Eisenberg's alleged trading.

9. In support of that testimony, Dr. Mordecai may present data regarding trading patterns for the MNGO-USDC currency pair and other MNGO and dollar-pegged stablecoin currency pairs in the months preceding and following October 2022. Specifically, Dr. Mordecai may present analyses showing trading prices and volumes of the MNGO-USDC cryptocurrency pair (or the pairing of MNGO and other dollar-pegged stablecoins) on various sources, including FTX, AscendEx, and Jupiter Aggregator, before and after Mr. Eisenberg's alleged trading. This analysis will show that, during the period of Mr. Eisenberg's trading, the price of MNGO relative to USDC and other dollar-pegged stablecoins increased drastically, for a brief period of time, then decreased sharply. It will also show that the volume of MNGO trading relative to USDC and other dollar-pegged stablecoins increased drastically, for a brief period of time, then fell sharply.[1]

10. In further support of the testimony described in paragraph 8, Dr. Mordecai may testify about Mr. Eisenberg's alleged trading on FTX, AscendEx, and Jupiter Aggregator on or about October 11, 2022. In particular, Dr. Mordecai may testify that the volume of Mr. Eisenberg's purchase orders of MNGO for USDC and other dollar-pegged stablecoins on FTX, AscendEx, and Jupiter Aggregator were magnitudes greater than the volume either preceding or subsequent to Mr. Eisenberg's trades on those sources. Dr. Mordecai may also present data showing the MNGO price increase relative to USDC on FTX, AscendEx, and Jupiter Aggregator contemporaneous with the execution of Mr. Eisenberg's purchase orders.

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[1] A *thin market* (*i.e.*, a market with *de minimus* and/or *intermittent order flow*, also known as a *narrow market*) exhibits price impact due to order-size sensitivity as a primary property, resulting in disparate, disproportionate, and/or discontinuous price changes conditional on large order arrivals. When the *ex-ante* number of buying and/or selling orders tends to be relatively small (and/or the arrival of orders tends to be intermittent), the marginal effect of a relatively outsized order can result in a corresponding disparate and/or disproportionate price impact. *See, e.g.*, Rostek, Marzena, and Marek Weretka, "*Thin markets*," The New Palgrave Dictionary of Economics (2008): 1-5.

11. Dr. Mordecai may further present analyses showing that the price of MNGO relative to USDC and other dollar-pegged stablecoins declined rapidly on FTX, AscendEx, and Jupiter Aggregator after Mr. Eisenberg's orders on those sources were filled. Dr. Mordecai may testify that the drastic increase then decrease of the MNGO price on FTX, AscendEx, and Jupiter Aggregator was caused by Mr. Eisenberg's large orders on those sources for MNGO at prices significantly above prevailing and historical market rates.[2] Dr. Mordecai may testify that Mr. Eisenberg's alleged trading of MNGO on or about October 11, 2022 was not economically rational as to obtaining exposure to MNGO.

12. Dr. Mordecai may testify that the price of MNGO-USDC Perpetuals on Mango Markets increased drastically during the period when Mr. Eisenberg was allegedly trading on or about October 11, 2022. Dr. Mordecai may present analyses showing the price of MNGO-USDC Perpetuals on Mango Markets during the months before and the weeks after October 2022. Dr. Mordecai may explain that Mr. Eisenberg's alleged trading caused the price of MNGO-USDC Perpetuals to drastically increase, for a brief period of time, relative to historical prices. Dr. Mordecai may also present analyses about how funding rates changed during that period of alleged purchasing compared to other periods.

13. Dr. Mordecai may testify that Mr. Eisenberg's alleged trading of MNGO on or about October 11, 2022 was not economically rational as a way to invest as to his offsetting MNGO Perpetuals positions. Dr. Mordecai may explain how the increase in the value of MNGO relative to USDC changed the value of Mr. Eisenberg's MNGO Perpetuals positions during this time, with his position on the long side increasing rapidly in value and his position on the short side simultaneously decreasing rapidly in value, with neither a net gain nor a net loss to Mr. Eisenberg across the two accounts which he both owned and controlled.

14. Dr. Mordecai may testify that, as the value of MNGO relative to USDC increased, the value of the Mango Markets account holding the Long Perpetuals Position increased, as well. Dr. Mordecai may testify that this increase in value enabled the owner of that account (allegedly Mr. Eisenberg) to borrow and withdraw large quantities of cryptocurrencies. Dr. Mordecai may present analyses showing the volume of cryptocurrency borrowed and withdrawn through the account holding the Long Perpetuals Position.

15. Dr. Mordecai may also explain that, as the value of MNGO relative to USDC fell following Mr. Eisenberg's cessation of trading, the value of the Mango Markets account holding the Short Perpetuals Position increased. Dr. Mordecai may testify that this increase in value enabled the owner of that account (allegedly Mr. Eisenberg) to borrow and withdraw large quantities of cryptocurrencies. Dr. Mordecai may present analyses showing the volume of cryptocurrency borrowed and withdrawn through the account holding the Short Perpetuals Position.

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[2] By definition, order imbalance in either direction (resulting from a surplus of either buy or sell orders, respectively) can reduce liquidity, and thereby "market-wide" returns (*i.e.*, aggregate price changes) are conditionally precipitated by contemporaneous and lagged order imbalances at the margin. The occurrence of sequential reversals in market returns (*i.e.*, the polarity of price changes) subsequent to high-negative-imbalance, large-negative-return periods have been empirically observed and documented, such that even after controlling for aggregate volume and liquidity, market returns are affected by order imbalance. *See, e.g.*, Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam, "*Order imbalance, liquidity, and market returns*," Journal of Financial economics 65.1 (2002): 111-130.

16. Dr. Mordecai may testify that the borrowing through the accounts allegedly held by Mr. Eisenberg were drastically larger than any borrowing historically done on Mango Markets and effectively depleted all available liquidity on the platform. Specifically, Dr. Mordecai may present analyses showing the amount of borrowing on Mango Markets in the months preceding October 2022, compared to the amount of borrowing done through the accounts allegedly held by Mr. Eisenberg, to describe an unprecedented scope and scale of borrowing.

17. Dr. Mordecai may testify that the borrowing through the accounts allegedly held by Mr. Eisenberg drastically increased the interest rates for borrowing cryptocurrencies on Mango Markets. Specifically, Dr. Mordecai may present analyses showing the historical interest rates applicable to borrowing cryptocurrencies on Mango Markets and compare those historical rates to rates caused by borrowing through the accounts allegedly held by Mr. Eisenberg.

18. Dr. Mordecai may testify that at least one of the accounts that held the Long and Short Perpetuals Positions were liquidated shortly after the aforementioned borrowing and withdrawals, and therefore interest went unpaid. Dr. Mordecai may explain a Mango Markets protocol for liquidation when an account deficit occurs such that the liabilities exceed the corresponding assets by a pre-specified amount. Dr. Mordecai may further explain that at least one of the accounts with the Long and Short Perpetuals Positions were liquidated, but that the amount recovered through the liquidation was far less than the amount borrowed and withdrawn through the accounts. Dr. Mordecai may testify that the amount the accounts would have owed in interest but-for the liquidations far exceeds the amount recovered from those accounts.

19. Dr. Mordecai will present analyses showing a comparison of interest rates applicable to Mr. Eisenberg's borrowing (relative to the prevailing historical rates applicable to other market participants).

D. Approval and Signature

I hereby approve the disclosure of my qualifications, anticipated opinions, and bases for such opinions, as set forth above.

David K. A. Mordecai, PhD

APPENDIX A

DAVID K.A. MORDECAI

3 Columbus Circle 15th Floor, New York, N.Y. 10019
Direct: (212) 208-3019 | Main/Fax: (212) 208-0997
Email: dmordecai [at] riskeconomics.com

EDUCATION[1]

University of Chicago Graduate School of Business, Ph.D. Economics and Econometrics/Statistics, 2004
New York University, Leonard N. Stern Graduate Business School, MBA Finance, 1987
The King's College, B.A. Philosophy/Humanities (Comparative Religion), 1983

PROFESSIONAL EXPERIENCE/EMPLOYMENT[2]

Numerati® Partners LLC (https://numeratipartnersllc.com/), Co-Managing Member, 2012-Present
Risk Economics®, Inc. (https://riskeconomicsinc.com/), President, 1999-Present
Swiss Re Financial Markets, Managing Director – Relative-Value Market Strategies, 2007-2008
Clinton Group Inc., Managing Director – Structured Products, 2001-2003
American International Group (AIG), Vice President – Financial Engineering/Principal Finance, Global Investments Group/Structured Products 2000-2001; Vice President – Financial Engineering/Executive Committee, AIG Risk Finance Division 1998-2000
Fitch IBCA, Director, Commercial Asset-Backed Securities (ABS) Group, 1997-1998
Westdeutsche Landesbank, Vice President, Leveraged Capital Group, 1990-1991
Emanuel & Company, Vice President – Corporate Finance, 1988-1990
Bankers Trust Associate – Corporate Finance, 1987-1988
NatWest NJ Commercial Credit Analyst, 1984-1986

CONSULTING/ADVISORY ASSIGNMENTS[2]

Analysis Group: Affiliated Expert 2022-Present
Colorado Attorney General Senate Bill 217 Pattern & Practice Investigation Technical Appendix, 2020-2021
FinTech Startup Technical Advisory Committees: ForwardLane 2018-Present; AlphaPoint 2016-Present
Compass Lexecon: Senior Advisor/Affiliate 2009-2014, 2022-Present; Advisory Committee 2011-2014
Swiss Re Financial Services and Capital Management Divisions, 2007
Shinsei Bank, 2006
Bartlit Beck Palenchar Herman & Scott, 2005-2006
S3 Asset Management/S3 Partners, 2005
HUD Diversified Mortgage CDOs, 2003
McDonald's Corporation USA, Technical Advisor to Chief Operating Officer North America Division, 1996
Credit Suisse First Boston (CSFB) High Yield, Leveraged Capital, and Financial Products, 1995
NYU Salomon Center for the Study of Financial Institutions, 1993
Bank of Montreal/Harris Bank and Trust, 1993
Pfizer; Hoffman-La Roche, 1992
Mutual Benefit Life; PSE&G/Deloitte; ADP, 1992
Asea Brown Boveri (ABB); Metromedia Communications, 1992
Den Norske Creditbank, 1986-1987

[1] See Appendix I for a summary of relevant post-graduate education; University of Chicago GSB was renamed Booth in 2008; previously NYU GBA was renamed Stern in 1988.
[2] See Appendix II for highlights of technical and financial markets assignments

PATENTS

US Patent # 7925581, 8032451, 8812397
System and method for dynamic path- and state-dependent stochastic control allocation: The invention includes a system and process that employs contractual bargaining with agent-based computational methods for the dynamic allocation, optimization, and pricing of contingent rights and obligations between multiple counterparties with overlapping interests.

EDITORIAL EXPERIENCE[3]

- Senior Editorial Advisory Board Member, *Journal of Risk Finance*, Emerald Publications, 2004-Present
- Founding Editor-in-Chief, *Journal of Risk Finance*, Euromoney Institutional Investor, 1998-2004
- Editorial Advisory Board, *Journal of Alternative Investments*, Euromoney Institutional Investor, 2004-2008
- Advisory Committee, *The Impact of Credit Derivatives on Securities Markets*, International Securities Markets Association (ISMA), 1998

PROFESSIONAL ACTIVITIES

- American Bar Association (ABA) Science & Technology Law, Space Law Co-Chair 2022-24
- ABA Science & Technology Law, Nanotechnology Chair 2021-24; Vice Chair 2020-21
- ABA Science & Technology Law, AI & Robotics Committee Vice Chair 2018-2022
- ABA Technical Advisor Appointed to Uniform Law Commission (ULC) Study Committees: Use of Tokens or Other Similar Products in Real Property Transactions 2022-Present; Mitigation of Public Health Emergency Business Disruptions 2020; Event Data Recorders in Cars 2019-Present
- Advisory Board for the Institute for Data Science (IDAS) at Durham University 2019-Present
- National Institute of Standards & Technology (NIST) *Position Navigation and Timing (PNT) Profile Industry Workshop* on Vulnerability of GPS/GNSS as a Single Point of Failure, Invited Participant 2020
- New York Academy of Sciences (NYAS) Artificial Intelligence (AI) Initiative Discussion Group on Public-Sector AI and Advanced AI Policy, Invited Participant 2020
- Peer review of Sloan Foundation Grant Proposal for funding a Cyberphysical Security Evaluation Effort, Invited Referee 2019
- NSF Northeast Big Data Hub Cybersecurity Committee, Co-Chair, 2018-2019
- AIG-NYU Partnership on Innovation for Global Resilience, Steering Committee Member, 2013-Present
- FinTech Innovation Lab (Partnership Fund for New York City and Accenture), *Scientist-in-Residence*, 2013-Present
- NYU Stern Graduate School of Business, Senior Research Scholar, Computational Economics of Law, Commerce, and Geo-Politics, 2012-2015
- NYU Center for Data Science Faculty Working Group, 2012
- NYU Courant Institute of Mathematical Sciences, Visiting Scholar; RiskEcon® Lab for Decision Metrics (https://wp.nyu.edu/riskeconlab/), Primary Senior Research Advisor, 2011-Present
- NYU Courant Institute of Mathematical Sciences, Computational Economics and Algorithmic Data Analytics Initiative affiliated with RiskEcon® Lab, 2011-Present
- NYU Courant Institute of Mathematical Sciences, Advisory Board, Mathematical Finance, 2010-Present
- International Association of Financial Engineers (IAFE) Advisory Board, 2001-Present[4]
- Founding Co-Chair IAFE Liquidity Risk Committee, 2005-2013
- IAFE Investor Risk Committee Steering Group, 2001-2013

[3] See Appendix III for a synopsis of relevant technical topics reviewed during tenure as Editor-in-Chief of *Journal of Risk Finance.*
[4] On October 13, 2013, the International Association of Financial Engineering (IAFE) announced that the organization had been renamed the International Association of Quantitative Finance (IAQF).

PROFESSIONAL ACTIVITIES (CONT'D)

- Board on Mathematical Sciences and Their Applications Division on Engineering and Physical Sciences National Research Council of the National Academies, Invited Presenter 2011
- Office of the Directorate of National Intelligence Systemic Risk Working Group, Invited Participant 2010
- National Academy of Sciences Working Group on Systemic Risk 2009, Technical Capabilities Necessary for Systemic Risk Regulation (Board on Mathematical Sciences and Their Applications, Invited Participant)
- Santa Fe Institute, Systemic Risk Initiative Symposium/Workshop 2009, Organizing Committee, and Speaker
- World Economic Forum Working Group on Systemic Risk 2009, Invited Participant
- Family Office Association Palm Beach Forum, Invited Participant 2018
- Federal Reserve Bank of Atlanta/IAFE 2006 *Modern Financial Institutions, Financial Markets and Systemic Risk*, Organizing Committee, Session Chair, and Discussant
- GAIM/IAFE Systemic Risk Symposium 2006, Session Co-Chair/Organizing Committee Chair
- GAIM *Advanced Topics in Structured Credit*, Session Chair, 2004-2006
- GAIM USA *Advanced Topics in Structured Credit*, Session Chair, 2006
- University of Chicago GSB Geo-Political Finance Forum 2005 Session Chair *Financial Intermediation, Innovation and Global Financial Stability: The Role of Regulatory Policy, Derivatives, and Securities in Geo-Political Finance*
- Wharton Financial Institution Center/Mercer Oliver Wyman Financial Risk Symposia, Participant, 2001, 2002
- National Bureau of Economic Research (NBER) Insurance Industry Working Group, Participant, 1999-2009
- NBER Risk in Financial Institutions Working Group, Participant, 2005-2012
- New York Mercantile Exchange (NYMEX) Institutional Investment Management Advisory Board Steering Committee Member, 1998-2003

MEMBERSHIPS

- American Bar Association 2010-Present; American Economic Association 1998- ; American Finance Association 1998- ; New York Association of Business Economists 2007- ; American Law & Economics Association 2013- , National Association of Business Economists, 2012-
- IEEE 1998-2001, 2013-Present; Association of Computing Machinery 2011-Present; New York Academy of Sciences 2012-Present; American Statistical Association 2012- Present; SIAM 2013-Present; NDIA 2018-Present; AFCEA 2018- ; International Society of Bayesian Statistics 2013-Present; INFORMS/NY 1998-2005

FELLOWSHIPS/HONOR SOCIETIES/AWARDS

- *Who's Who in Finance and Industry* (Marquis), various editions
- *Who's Who in Business* (Marquis), various editions
- *Who's Who in the World* (Marquis), various editions
- *Who's Who in America* (Marquis), various editions
- *Who's Who Among African-Americans* (Gale)
- *Minority & Women Doctoral Directory*
- Sir Harold Acton Society (philanthropy in STEM and the establishment of RiskEcon® Lab at Courant NYU)
- Beta Gamma Sigma Honor Society
- University of Chicago Doctoral Fellowship, 1993-2004
- Salomon Center Research Fellowship, 1993
- NYU GBA Dean's Service Award 1987; Chase Manhattan Fellowship 1986
- The Society of Distinguished American High School Students, 1977

EXPERT TESTIMONY

- Catapult IP Innovations, Inc. v. BlackBerry, Limited, JAMS No. 5425001101, technology intellectual property portfolio sale dispute, M&A reinsurance; expert report and rebuttal damages report filed (October 2023).
- Douez v. Facebook, Inc., In The Supreme Court of British Columbia, Vancouver Registry, VLC-S-S-122316. Expert testimony provided related to the determination of class size; expert report filed (August 2023).
- American Arbitration Association arbitration (confidential) re: VLSI supply-chain and volatility-based damages analysis for Bitcoin token mining ASIC rig capacity contract dispute; expert report filed (June 2023), testified at deposition (July 2023) and at arbitration (October 2023).
- Lehman et al. v. Transbay Joint Powers Authority (TJPA), Millennium Tower Association v. Mission Street Development, LLC et al, and related cases In the Superior Court of the State of California, County of San Francisco, Case Number: CGC 17-557830. TJPA joined by Millennium Tower Association (MTA) in opposing the summary judgment motion filed by the engineering related to successor liability from its 2010 acquisition via an asset purchase agreement (APA) of the geotechnical engineering firm for the Millennium Tower, expert report filed and testified at deposition (February 2019).
- MF Global Holdings Ltd., as Plan Administrator v. PricewaterhouseCoopers, In the United States District Court Southern District of New York Case No. 14-cv-2197 (VM), expert reports filed (August and November 2015).
- MF Global Holdings Ltd. Investment Litigation, Joseph Deangelis (Tavakoli) v. Corzine et al, In the United States District Court Southern District of New York 12 MD 2338 (VM), 11 Civ. 7886 (VM), expert reports filed August and September 2015, testified at deposition (November 2015).
- Microsoft v. Samsung, Civil Action No. 14-CV-6039; re: merger dispute related to intellectual property assignment; expert report filed (December 2014).
- Starr International Company v. United States, In the United States Court of Federal Claims, No. 11-CV-00779; re: evaluating the economic and market evidence corresponding to the financing extended to rescue AIG, expert report filed (April 2014), testified at deposition (June 2014) and at trial (November 2014).
- Offshore Exploration and Production, LLC v. Korea National Oil Corporation and Ecopetrol S.A., In the American Arbitration Association International Centre For Dispute Resolution; re: common market practice and convention for trading fixed income instruments within the context of a Stock Purchase Agreement and an Indemnification Escrow Agreement; the recognition of interest income as it relates to premium bonds; commercial reasonability of investor expectations regarding returns on Treasury-backed investments, expert report filed (December 2013), testified (February 2014) and supplement submitted (August 2015).
- Technical advisor in international arbitration involving Benelux bancassurance conglomerate; re: an econometric model, based upon well-established statistical methodology and generally accepted industry practice, to identify a portfolio of peer banks with comparable exposures, based upon contemporaneous market prices and relative returns, technical appendix submitted with report filed (November 2013).
- Anwar et al. v. Fairfield Greenwich Limited, et al., In the United States District Court Southern District of New York, Master File No. 09-CV-118; re: commercial reasonability of investor expectations re: due diligence and monitoring roles of manager relative to fund administrator and custodians, expert report filed (October 2013), testified at deposition (April and May 2014), supplemental report filed (September 2014).
- Retirement Housing Foundation et al v. ACA Financial Guaranty; Cain Brothers & Co. LLC and DOES 1-20 inclusive, Superior Court of Los Angeles County, California, Case No. BC404726, declaration filed in opposition to Cain Brothers' statute of limitations motion for summary judgement in a swap contract dispute (signed April 2013; filed May 2013).
- Ironshore Insurance Ltd v. Western Asset Management Company No. 11 Civ. 5954 (LTS)(JCF), In the Federal Court of Southern District of New York Case No: 1:2011cv05954; re: topics related to the valuation, performance attribution and stress testing of fixed income portfolio management assignment on behalf of a property-casualty insurer; expert report (March 2013) and rebuttal report filed (April 2013), testified at expert deposition.

EXPERT TESTIMONY (CONT'D)

- Eastham Capital Appreciation Fund v. KPMG LLP, Arbitration; re: commercial reasonability of investor expectations re: due diligence and monitoring roles of manager relative to fund auditor duties, expert report filed (April 2013).
- City of Phoenix v. Ambac Assurance Corporation, MBIA Insurance Corporation, Inc., and Financial Guaranty Insurance Company, Case No. CV 2010-00555-PHX-TMB; re: insurance risk factors and comparative economics between financial guaranty insurance referencing municipal, corporate and structured finance; expert report and rebuttal report filed (April and May 2013).
- Sheila M. Gowan, Chapter 11 Trustee for Dreier LLP v. Amaranth Advisors L.L.C. and Amaranth Partners LLC. In the United States Bankruptcy Court Southern District of New York, Chapter 11 Case No. 08-15051 (SMB); re: commercial reasonability of due diligence performed; expert report filed on (November 2012), rebuttal report filed (January 2013), testified at deposition.
- HSH Nordbank AG, v. UBS AG and UBS Securities LLC, In the Supreme Court of the State of New York County, New York, Case No. 6000562/08; re: Actively Managed Synthetic CDO structure referencing RMBS; testified at deposition (July 2011).
- Genetically Modified Rice Litigation, Multidistrict litigation, In the United States District Court, Eastern District of Missouri, Eastern Division, Case No. 4:06 MD 1811 CDP; re: economic damages from alleged contamination of U.S. rice crop; testified at deposition (April 2011).
- API, Inc. Asbestos Settlement Trust and A.P.I. Inc. v. Zurich-American Insurance, In the United States District Court of Minnesota, Case No. 09-CV-00975 JRT/JJG et al.; re: finite reinsurance involving commercial liabilities of insurer in runoff, testified at deposition (March 2011).
- MAXXAM Inc. v. Timothy C. Ford and Kevin D. Laurie, FINRA Arbitration No. 09-5147CH; re: cause and foreseeability related to failure of Lehman sponsored Auction Rate Securities at arbitration; testified (on behalf of Ford and Laurie as respondents) at arbitration (January 2011).
- Scott Meins, et al. v. Bayer AG, et al., In the Circuit Court of Arkansas County, Arkansas, Stuttgart District, Civil Division, Case No. CV-2008-108; re: damages from alleged contamination of U.S. rice crop; reports filed, testified at deposition (January 2011).
- Amaranth LLC et al. v. J.P. Morgan Chase & Co. et al., In the Supreme Court of the State of New York County, New York, Case No. 603756/07; expert report filed, testified at deposition November 2010.
- Jesse Briggs, et al. vs. Bayer Cropscience, LP, et al., In the Circuit Court of Jefferson County, Arkansas, Case No. CV-2009-173-5; re: damages from alleged contamination of U.S. rice crop; reports filed, testified at deposition (September 2010).
- Doyle Sims, et al. v. Bayer Cropscience, LP, et al., In the Circuit Court of Desha County, Arkansas, Civil Division, Case No. CV-2009-118-3, (damages from alleged contamination of U.S. rice crop; reports filed, testified at trial on behalf of Bayer defendants (July 2010).
- Abu Dhabi Commercial Bank et at v. Morgan Stanley & Co. et al Civil Action No. 1:08-cv-07508 re: Cheyne SIV; rebuttal response declaration supporting plaintiff's motion for class certification (April 2010).
- Frontier Oil Corporation v. National Union Fire Insurance of Pittsburgh PA et al., In the Central District Superior Court of Los Angeles County, California, Case No. BC311259, (finite reinsurance case), declarations filed, testified at deposition (January 2010) and at trial (April 2010) on behalf of defendant RLI Insurance.
- Fifth Third v. TransAmerica Insurance Company, In the Southern District Court of Ohio, Western Division, Case No. 1:08 CV 269; re: Separate Account Bank-Owned Life Insurance (BOLI); expert report filed (December 2009), testified at deposition (January 2010).
- Tyson Partners, L.P. (f/k/a Altaris Partners), LLC vs. AIG Global Asset Management Holding Company, (re: industry practice with regard to private equity joint-venture capital call funding obligations and the economics of those obligations; expert report filed, testified at Arbitration (September 2009).

ARTICLES/PUBLICATIONS

Technical Pre-prints Posted (2020- : See https://wp.nyu.edu/riskeconlab/about/research/)

Rohith G. Ganesan, Samantha Kappagoda, Giuseppe Loianno, and David K.A. Mordecai (2021) *Comparative Analysis of Agent-Oriented Task Assignment and Path Planning Algorithms Applied to Drone Swarms* (arXiv:2101.05161)

Ryan C. Saxe, Samantha Kappagoda, and David K.A. Mordecai (2020) *Classification of Pathological and Normal Gait: A Survey* (arXiv:2012.14465)

Mengheng Xue, Samantha Kappagoda, and David K.A. Mordecai (2020) *Energy Disaggregation with Semi-supervised Sparse Coding* (arXiv:2004.10529)

Doctoral Dissertation

"*The Limits of Arbitrage: An Empirical Analysis of Evidence from Hedge Fund Performance*" developed and employed an application of multivariate principal component analysis to perform econometric tests of decision and control problems related to risk management and capital allocation for dynamic relative-value trading strategies. Examines how the performance and risk-based leverage of hedge funds pursuing diverse active trading strategies respond to volatility shocks. The decomposition of hedge fund performance into risk-based leverage factors, and the estimation of response functions of contingent liabilities to volatility shocks, also addresses broad market and policy implications regarding externalities, contagion effects, and systemic risk management across both diverse trading strategies and asset classes.

Published Chapters

"Applications of Structured Correlation Products to Credit Risk Intermediation" in Tilman, L. M. (Ed.), *Asset Liability Management of Financial Institutions*, Institutional Investor Books, 2003

"The Role of Hedge Funds as Asset Managers in Pension Life Annuity and Property-Casualty Reinsurance Covers" in Lane, M. (Ed.), *Alternative Risk Strategies*, RISK Books, 2002

"Insurance Risk Securitization, Model Robustness, and the Convergence of Event and Credit Risk: A Rating Analyst's View," in Himmick, M, and S. Bouriaux (Eds.), *Securitized Insurance Risk: Strategic Opportunities for Insurers and Investors*, Glenlake Publishing Company, 1999

"The Use of Credit Derivatives in Credit-Enhanced and Credit-Linked Structured Notes: A Former Rating Analysts Perspective," Francis, J., J. Frost, and G. Whittaker (Eds.), *The Handbook of Credit Derivatives*, McGraw-Hill, 1999

"Alternative Risk Transfer: Investing Directly in Insurance Risk as an Alternative Investment Strategy," Schneeweis, T. and J.F. Pescatore (Eds.), *The Handbook of Alternative Investment Strategies*, Institutional Investor Books, 1999

"Event Risk Management and Arbitrage: Synthetic Credit Structures" in Lake, Ron (Ed.), *Credit Derivatives: Applications for Risk Management*, Euromoney Books, 1998

"Emerging Market Credit Derivatives and Default Estimation: Volatility, Business Cycle Correlation and Portfolio Diversification" (with S. Kappagoda) in Jameson, R. (Ed.), *Credit Derivatives: Applications for Risk Management, Investment and Portfolio Optimisation*, Risk Books, 1998

ARTICLES/PUBLICATIONS (CONT'D)

Articles

"The Critical Role of Transmission and Storage Capacity in Balancing Intermittent Generation and Transient Load" American Bar Association (ABA) *Natural Resources & Environment* Winter 2023

"Uncertainty and Reliability Implications of Computer Vision Depth Estimation for Vehicular Collision Avoidance and Navigation (Parts 1 & 2)," (with Samantha Kappagoda and John Y. Shin), ABA *SciTech Lawyer Unintended Consequences Issue*, Fall 2022 & Winter 2023

"Automated Personal Assistants with Multiple Principals: Whose Agent is it?" ABA *SciTech Lawyer* Winter 2020

"Weather Derivatives: A Tool for All Trades" *Energy and Power Risk Management* and RISK Special Issue, RISK Publications, 1998

"Limited Liability for Lloyd's" *Barrons* (Editorial), 1985

Case Studies

"Forward Pricing of Corresponding Aging, Mortality and Medical Trends" Swiss Re, 2008

"Finance for an Italian Library of Movies," (with G. Pini) Fitch IBCA, 1998

"Swiss Re Earthquake Fund," Fitch IBCA, 1998

"Residential Reinsurance Limited/United States Automobile Association," Fitch IBCA, 1997

"The Restructuring of International Harvester into Navistar," NYU Stern GBA, 1987

"Japan's Big Bang: How Deregulation and Global Entry into the Japanese Securities Industry Contributed to the Revaluation of the Nikkei and Japanese Real Estate," NYU Stern GBA, 1986

Working Papers Organized by Topic

Systemic Risk

Consumption-Based Forward Pricing of Insurance and Pension Risk

A Comprehensive Framework for Consistent and Coherent Forward Pricing of Systemic Risk

Risk Management and Risk Finance

"Forging Best Practices in Risk Management" U.S. Treasury Office of Financial Research (OFR) Working Paper #2 (with Paul Glasserman, Cliff Rossi, and Mark J. Flannery), 2012

"Computational Limits of Arbitrage and Market Externalities: The Implications of Search and Matching Costs on the Market Dynamics of Carry Trades"

"To Search but (perhaps) Not Find: Systemic Risk, Network Externalities, and Counterparty Coordination Failure in a Multi-Agent Capacity Game with Random Shocks and Stochastic Arrival of Types"

"Risk Finance and Risk Shifting by Strategic Traders: A Multi-Period Model of Disintermediation with Information Asymmetry, Contingent Liability, and Asset Substitution"

"Market Conditions and the Limits of Arbitrage: Hedge Fund Performance and the Leverage Implicit in Dynamic Trading Strategies," University of Chicago, 2000

ARTICLES/PUBLICATIONS (CONT'D)

"A Model of Debt Capacity and Borrowing Capacity for Performance-Based Arbitrage," University of Chicago, 2000

"When Does Size Matter? The Role of Collateralized Financing in the Performance of Hedge Funds and CTAs," University of Chicago, 2000

"The Race to Exit: A Three Period Model of Arbitrageur Leverage Changes in a Competitive Dealer Market with Costly Monitoring," University of Chicago, 2000

"The Efficient Pricing, Allocation and Distribution of Event Risk in the Reinsurance and Capital Markets," University of Chicago, 1999

"Event Uncertainty, Price Dispersion, and the Quality of Risk Premia: The Equilibrium Pricing of Event Risk in the Reinsurance Markets," University of Chicago, 1998

"The Pricing of Intermediated Event Risk: An Analysis of the Dual Market Pricing of Comparable Risks," University of Chicago, 1998

"Criteria for Rating Catastrophic Risk Securities," Fitch IBCA, 1997

Bayesian Approach to Option Valuation

"A Hierarchical Model of Black-Scholes with Stochastic Volatility: Monte Carlo Tests of Pricing Bias Sensitivity to Model Parameters," University of Chicago, 1997

"A Hierarchical Model of Black-Scholes with Stochastic Volatility" (with C. Harris and D. Pelleg), University of Chicago, 1994

Statistical Credit Risk and Default Estimation

"A Cash Flow Volatility Based Characteristics Model for Estimating Default Proximity of Franchise Loan Syndication," Fitch IBCA, 1998

"Fundamental Determinants of High Yield Bond Yields," University of Chicago, 1996

"An Analysis of the Capital Market Response to HLT lending Regulation: Evidence from Abnormal Returns," University of Chicago, 1996

"The Application of the Stein Estimator to Predicting Industry Distress for Pricing and Asset Allocation Within a Portfolio" (with D. Glickman), University of Chicago, 1995

"Industry-Driven Determinants of Default for Asset Sale LBO's in the 1980's," University of Chicago, 1994

"The Default Premium and the Role of High Yield Debt in the 1980's," University of Chicago, 1994

"A Review of the Methodology and Selected Results from 'Business Conditions and Expected Returns on Stocks and Bonds by Fama-French (1989)" (with D. Glickman), University of Chicago, 1994

"An Analysis of the Impact of HLT lending Regulation on Distress Costs for Highly Levered Firms" (with Berg, Goulet, Lyman and Whitney), University of Chicago, 1994

ARTICLES/PUBLICATIONS (CONT'D)

Empirical Corporate Finance/Capital Structure Theory

"A Model of Interdependence and Conflicting Incentives Between Bankers and Analysts," University of Chicago, 1996

"The Five Percent Rule: Stigler's Capture Theory and the Ownership of Non-Financial Firms by Banks," University of Chicago, 1995

"An Experimental Framework for Testing the Relationship Between Commitment Escalation and Coalition Formation with Sunk Cost", University of Chicago, 1995

"Evidence That Takeover Targets Overinvest: The Implications for Organizational Escalation of Commitment," University of Chicago, 1995

"An Analysis of Overinvestment and Diversification by Takeover Targets," University of Chicago, 1994

"Voluntary Corporate Spinoffs," University of Chicago, 1994

INVITED PRESENTATIONS/PLENARY ADDRESSES

- Transformative Impact of AI on the Legal Profession, *Generative AI Tools: How Transformation Occurs*, and *Navigating the Future: Including AI and the Changing Regulatory Landscape*, Invited Panelist 2023
- NYU School of Law, The Future of AI & the Law: Risks, Opportunities and Challenges, *Artificial Intelligence (AI) in Financial Services: Cementing Industry Gains Through Governance and Guardrails*, Invited Panelist 2023
- Cournot Centre *The Modeling of Markets with Complex and Rough Regimes*, Session Chair 2022
- Colorado Bar Association Panel *Perspectives from an Expert Witness* moderated by Eric Olson, Solicitor General, Office of the Colorado Attorney General, Invited Panelist 2021
- Institute of International Bankers (IIB) Panel *Climate Change Scenario Analyses*, Invited Panelist 2021
- Courant Institute for Mathematical Sciences NYU Center for Atmosphere Ocean Science (CAOS) Atmosphere Ocean Science Colloquium Presentation *Multi-resolution Remote-Sensing and Data Fusion for Multi-Modal Estimation of Mesoscale Terrestrial Atmospheric Scattering Fields: Statistical Models and Applications to Risk Domains*, Invited Presenter 2021
- American Bar Association (ABA) Artificial Intelligence and Robotics National Institutes Conference (AINI) *Data Dump: How to Deal with a Heap of AI Big Data Liability and Compliance Issues* Invited Panelist, 2021
- ABA AINI Conference *Investigations in the Era of AI*, Invited Panelist 2020
- ABA SciTech Section Virtual CLE Panel, Invited Panelist 2019
- ABA-IPL Annual Meeting and 34th Intellectual Property Law Conference, Invited Panelist 2019
- ABA-IPL Privacy Committee Dinner (discussing topics in cybersecurity), Invited Keynote 2019
- W3C Workshop on Data Models for Transportation *Digital Forensics for Measurement and Control and the Vehicle Testimony and Behavior Implications for Cyberphysical Risk Reliability and Security of Internet of Things (IoT),* Invited Presenter 2019
- U.S. Department of Defense/ONR HacktheMachine Lightning Presentation, Invited Presenter 2019
- U.S. Commodity Futures Trading Commission's (CFTC) Second Annual Fintech Forward Conference Panel (discussing frameworks and criteria to enable reliable Artificial Intelligence), Invited Panelist 2019
- Center for Strategic and International Studies (CSIS) Defense Industrial Initiatives Group (DIIG) Senior-Level Discussion Workshop Sessions, *Artificial Intelligence (AI) and Applications to National Security*, on tactical and strategic issues of data ownership, software acquisition and network risk management for trust, verification and reliability of AI systems, Invited Participant 2018

INVITED PRESENTATIONS/PLENARY ADDRESSES (CONT'D)

- Day Pitney Family Office Forum 2018, Invited Panelist 2018
- InsurTech Alliance Science and Engineering Innovation Expo, Keynote Speaker 2018
- New England Conference of Public Utilities Commissioners (NECPUC) Symposium, *Hair-Raising Hazards; Analytical Frameworks for Risk & Catastrophic Events. Hair Raising Hazards from AI, ML & IoT: Adaptive Response to Cyberphysical Risks*, Invited Panelist 2018
- Armed Forces Communications and Electronics Association (AFCEA) 2018 Internet of Things (IoT) Summit, *IoT Procurement: Assembling the Pieces*, Invited Panelist 2018
- NYU Joint Quantum Symposium, *Future of Quantum Information*, Invited Panelist 2018
- AFCEA, *Artificial Intelligence: The Next Line of Defense*, Invited Panelist 2018
- Accenture Insurtech Summit, *Big Data: The Oxygen of Life Underwriting*, Invited Panelist 2017
- Family Office Association Annual Conference, Invited Keynote Speaker 2017
- National Governors Association *Industrial Internet of Things* ("IIoT") Forum, Invited Participant 2017
- Global Association of Risk Professionals (GARP) Panel, *What Blockchain Means for Risk Management*, 2016
- SwissNex New York Outpost *The Power of Big Data: Shaping the Future of FinTech*, Invited Panelist 2016
- RIMS 2016 Annual Conference, *Adaptive Response to Cyberphysical Infrastructure Risk: The State of the Art* Cyber Terrorism: Protecting Critical Infrastructure, Invited Panelist 2016
- Accenture Technology Vision, *People First: The Primacy of People in the Digital Age*, Invited Panelist 2016
- American Association of State Compensation Insurance Funds (AASCIF) Annual CEO Conference, Invited Presenter 2015
- Workers Compensation Fund (WCF) Senior Management Annual Meeting, Invited Presenter 2015
- AASCIF Annual Conference *Bridging the Future*, Invited Presenter 2015
- AASCIF Mid-Year CEO Conference, Keynote 2015
- Reinsurance Association of America *Supply-Chain Risks and Contingent Business Interruption: Forensic RiskTech for Reinsurers as the Strategic Response to Opportunities and Threats from Disruptive Technology*, 2014
- SCOR Americas Regional Partners *Navigating the Emergent Risk Landscape: Scalable Data Analytics*, 2014
- Director's Roundtable, A Dialogue with Nobel Laureate Harry Markowitz: Opportunities & Challenges in Applying Financial Techniques During a Crisis, (UCLA) *The Good, Bad & Ugly Redux: Risk Governance and Understanding the Implications of When, Why, and How Models Fail*, Invited Panelist 2013
- Director's Roundtable, Key Issues for Boards of Directors: Opportunities & Challenges in CyberTech (NYC) *The Computational Economics of Data Forensics, Cybersecurity and Digital Discovery: Opportunities and Threats of Cyborg Commerce for Corporate Risk Governance and Liability on the Wild Frontier*, Invited Panelist 2013
- National Association of Business Economists (NABE) Annual Conference 2012, Bridging the Gap Between Finance and the Real Economy, *Computational Economics and Big Data: How Technology is Transforming Business Decision Making*, Invited Panelist/Presenter 2012
- The Department of Treasury Office of Financial Research (OFR) & Financial Stability Oversight Council (FSOC) Conference The Macroprudential Toolkit: Measurement and Analysis, Risk Management: What's the Frontier?, *Forging Best Practices in Risk Management*, Invited Panelist/Presenter 2011
- National Academy of Sciences: Summit for Managing Extreme Events, Invited Panelist 2011
- Fidelity Center for Applied Technology/Santa Fe Institute Business Network Symposium, *Software Complexity: Implications for the Capability, Integrity, and Security of Large-Scale Software Systems, Implications for the Financial Industry*, Invited Presenter 2011
- Society of Casualty Actuaries Conference, *Harnessing Large Datasets to Navigate the Emerging Risk Landscape*, Invited Panelist 2011
- HB (formerly Mealey's) 18th Annual Insurance Insolvency & Reinsurance Roundtable, *Economic and Business Implications of a Changing Business Environment*, Keynote Panelist 2011

INVITED PRESENTATIONS/PLENARY ADDRESSES (CONT'D)

- Federal Reserve Day Ahead Conference on Financial Markets and Institutions, Discussion of *Stock or Options: Risk Choices and Compensation Design*, Invited Discussant 2011
- The Reactions Conference: Risk and Capital Management in the North American Insurance Industry, *The Longevity Problem and Long-Tailed Risk Mitigation*, Invited Presenter 2010
- HB 17th Annual Insurance Insolvency & Reinsurance Roundtable, *Litigation and Regulatory Implications of Environmental, Economic, Life, Health and Casualty Exposures*, Session Chair/Panelist 2010
- HB 16th Annual Insurance Insolvency & Reinsurance Roundtable, Regulatory Modernization: *Understanding the Economics of Systemic Risk Underlying Insurance Surplus and Reserves*, Invited Panelist 2009
- Food Security Stakeholder Discussion Session (hosted by Pew Charitable Trusts and sponsored by United Health Foundation, MIT Collaborative Initiatives and Earth Institute at Columbia University Urban Design Lab), Refocusing the Food System, Invited Participant 2010
- Santa Fe Institute Systemic Risk Initiative Symposium, *Information Cascades and Statistical Implications of Networks with Bayesian Agents*, Joint Presentation (with Nicholas G. Polson), Invited Presenter 2009
- World Economic Forum, London, *Managing Population Demographic Risks*, Invited Presenter 2008
- ISDA Annual General Meeting, *Emergent Longevity/Mortality Derivatives*, Invited Presenter 2008
- Deloitte Global Financial Services Conference, *Managing Population Demographic Risks*, Invited Presenter 2008
- Oliver Wyman Institute London, *Emergent Longevity/Mortality Derivatives*, Invited Presenter 2008
- Federal Reserve Bank of Atlanta Financial Markets Conference, *Credit Derivatives: Where's the Risk, The Good, The Bad and The Ugly: Liquidity Risk in the $27 Trillion Credit Derivatives Market*, Invited Presenter 2007
- Federal Reserve Bank of Richmond Credit Markets Symposium, *The Good, The Bad and The Ugly: Liquidity Risk in the $27 Trillion Credit Derivatives Market*, Invited Presenter 2007
- Federal Reserve Bank of Atlanta, Modern Financial Institutions, Financial Markets, and Systemic Risk Symposium, *Discussion of Carry Trades and Speculative Dynamics*, Discussant 2006
- Wharton Club of New York, *Reinsurance and Hedge Funds*, Session Chair 2006
- Wharton Investment Management Conference *Fixed Income Investments*, Invited Panelist 2005
- Federal Reserve Bank of New York/Princeton, *Liquidity Risk Conference*, Practitioner Discussant 2005
- Commodity Futures Trading Commission Roundtable on Hedge Funds and Commodity Pool Operators, Invited Presenter 2005
- IRC Conference Hedge 2005 *When Volatility Shocks Occur and Bad Things Happen to Good Managers: Risk-Based Leverage, Market Liquidity and the Funding Gap*, Invited Presenter 2005
- Day Robinson *Structured Commodity/Trade Credit Conference*, Practitioner Panel 2005
- Euromoney Structured Trade and Export Finance in the Americas, Invited Presenter 2005
- 100WHF 4th Annual Risk Management Panel *When Shocks Occur: Risks, Threats and Opportunities for Hedge Funds Related to the Current and Future State of Global Financial Markets and Institutions* Chair
- GAIM 2005 Research Paper of the Year *When Bad Things Happen to Good Managers: Risk-Based Leverage, Volatility and the Limits of Arbitrage*, Keynote Address 2005
- GAIM 2004 *The Changing Role of Structured Credit in the ALM of Financial Intermediaries*, Invited 2004
- GAIM 2003/IAFE Investor Risk Committee Panel on *Hedge Fund Risk Transparency and Valuation*
- GAIM 2003 *An Examination of the Linkages Between Hedge Funds and Insurers*, Invited Presenter 2003
- IAFE Investor Risk Committee Panel *Hedge Funds at the Crossroads*, Invited Panelist 2003
- Euromoney ALM Conference 2003 *ALM and Credit Risk Intermediation*, Invited Presenter 2003
- GAIM 2002 *The Role of Credit Derivatives in Alternative Investment Strategies* and *Advanced Structured Credit Products Seminar*, Invited Faculty 2002

INVITED PRESENTATIONS/PLENARY ADDRESSES (CONT'D)

- IAFE Investor Risk Committee *A Proposed Methodology for Factor-Based, Strategy-Specific Aggregate Risk Measurement for Highly Leveraged Institutions*, Invited Presenter 2002
- IAFE/IQPC Investor Risk Committee *Transparency and Disclosure for Hedge Funds and Funds-of-Funds*, Invited Panelist 2002
- IAFE/RISKinvest Investor Risk Committee, Invited Panelist 2002
- IAFE Investor Risk Committee Industry/Regulatory Panel *Hedge Funds at the Crossroads*, Invited Panelist 2002
- ICBI Risk Management and Derivatives Conference, Invited Panelist/Presenter 2002, 2003
- IQPC Hedge Funds for Pension Funds ALM 2002 *The Role of Dynamic Trading Strategies and State-Dependent Nonlinear Payoffs in Pension Liability Management*
- IMN/Fabozzi 2nd Annual Forum on Credit Derivatives and Synthetic Securitization, *Overview of the Credit Default Swap Market*, Invited Panelist 2002
- RISK ALM 2002 *The Role of Hedge Funds in ALM for Pensions and Insurers*, Invited Presenter 2002
- RISK Europe 2002 *Estimating Risk-Based Leverage and the Skewness and Kurtosis of Statistically Uncorrelated Returns*, Invited Panelist/Presenter 2002
- RISK Asset Liability Management Conference 2002 *The Role of Dynamic Strategies in ALM for Pensions and Insurers*, Invited Presenter 2002
- RISK ALM 2001 *Aggregating and Modeling Imbedded Optionality in the Balance Sheet*, Invited Presenter 2001
- IQPC Hedge Funds for Pension Funds ALM 2001 *ALM Considerations in Allocating to Alternative Investment Strategies*, Invited Presentation 2001
- IIR Risk Management Forum 2001, *Customizing Structured Products to Meet Investors' Risk Profiles: Using Swaps and Options to Target Specified Risk/Return Profiles for an Underlying Basket of Hedge Funds*
- Managed Funds Association Forum 2001 *How to Structure Tax-Efficient Hedge Fund Products*
- RISK Europe 2001 *Performance Measurement, Portfolio Insurance and Portable Alpha: Excess Return or Unpriced Risk*, Invited Panelist/Presenter 2001
- RISK USA 2001 *Risk-Based Leverage Factors Underlying Hedge Fund Linked Securities*
- RISK Asset Liability Management Conference 2001 *Aggregating and Modeling Imbedded Optionality in the Balance Sheet*, Invited Presenter 2001
- OpRISK 2001 *Coordination Failures: Sources of Operational Risk in Financial Intermediation*, Invited Presenter
- Credit RISK Summit 2000 *Assessing the Counterparty Credit Exposures of Banks and Securities Firms to Highly Leveraged Institutions*, Invited Presenter 2000
- RISK Europe 2000 *Identifying Embedded Optionality in Structured Notes and Hedge Fund Financing*
- RISK USA 2000 *Principal Components Analysis of Risk Factors Underlying Dynamic Trading Strategies*
- Credit RISK Summit 1999 *The Risks of Structured Credit Products and Collateralized Investment Obligations Linked to Alternative Asset Classes*, Invited Presenter 1999
- Energy & Power Risk Management 1998 *Hedging with Weather and Insurance Derivatives*, Invited 1998
- RISK Catastophe Risk Securities 1998 *Assessing Model Risk Underlying Catastrophe Risk Securities*
- IFR Credit Derivatives Conference, 1998
- Strategic Research Institute (SRI) Structured Finance Industry Conferences, 1997-2003
- IMN/Fabozzi Structured Finance Industry Conferences, 1997-2003

Industry Seminars

- InsurTech Alliance (ITA) Quarterly Industry Technology Consortium Technical Presentations 2019-2020
- Practicing Law Institute *Emergent Longevity/Mortality Derivatives,* 2007, 2008
- FinTuition Seminar *Structured Credit Relative-Value Strategies,* 2004
- Financial Research Associates Technical Conference *Hard-to-Value Assets,* 2004
- Financial Research Associates Technical Conference *Hedge Fund Analytics,* 2001-2004
- International Center for Financial Asset Management and Engineering (FAME), 2002
- GAIM Technical Seminar Advanced Topics in Structured Products, 2001-2002

APPENDIX I - POST-GRADUATE EDUCATION

Primary Ph.D. Concentrations

Industrial Organization/Applied Game Theory
- Industrial Organization
- Economics of Financial Regulation
- Advanced Industrial Organization
- Economics of Information and Uncertainty

Econometrics/Mathematical Statistics
- Probability and Bayesian Statistics
- Bayesian Statistical Inference
- Econometric Theory and Methods
- Multivariate Econometric Analysis

Bayesian Decision Theory
- Bayesian Computational Methods

Secondary Ph.D. Concentrations/Coordinated Course Sequences

- Asset Pricing, Continuous Time Finance, Option Theory, Financial Intermediation and Regulation, and Corporate Finance
- Behavioral Decision Theory/Decision Analysis
- Experimental/Behavioral Game Theory
- Theory and Empirical Analysis of Economic Social Networks

APPENDIX II – SELECTED TECHNICAL/FINANCIAL ENGINEERING ASSIGNMENTS

Numerati® Partners: Industry-commissioned proprietary research (2018-2020), including over (a) 104 technical peer reviews and (b) 14 in-depth technical evaluations/assessments of functionality, reliability, and security, as well as red team testing and edge-case analysis, across the following use-case application domains: automotive telematics; computer vision (e.g., range imaging, RGB-D, *optical character recognition* (OCR), object detection, optical defect detection); virtual/augmented reality; wearable technology; remote-sensing/satellite imaging; geo-fencing; mobile fleet, commercial (e.g. fault detection) and residential *internet-of-things* (IoT) sensor networks (e.g., electricity, fire, water intrusion monitoring); IoT cybersecurity; anomaly/outlier analytics (e.g., fraud detection); data warehousing, search/information retrieval; *natural language processing* (NLP)/text recognition; distributed ledger/blockchain technology; workflow *robotic process automation* (RPA)

Compass Lexecon: Technical advisor to a valuation team conducting independent analysis of the $15 Billion notional Lehman EMTN structured notes portfolio on behalf of the creditor committee; Technical oversight of bank stress-testing methodology during regulatory investigation of US subsidiary of SIFI-designated EU-based global bank; Technical advisor in international arbitration involving Benelux bancassurance conglomerate. Other technical oversight/advisory and subject matter assignments include: contingent equity forwards; leveraged credit-linked auction-rate securities structure; ABX-index CDOs; Dark pool liquidity; Asset-backed commercial paper (ABCP) residential mortgage backed securities (RMBS) warehouse facility; ethanol refining spread; american depository receipts (ADRs)

Swiss Re: Development of market-consistent, dynamic economic frameworks (benchmarks, indices, metrics, best practice) for relative-valuation of surplus and reserves corresponding to environmental and geo-political risks, demographics and market volatility regime changes; longevity/mortality, population aging, and medical consumption models of underlying long-dated, contingent liabilities related to life, health, and pension exposures

S3 Asset Funding: Development and implementation of term financing vehicle for convertible bond and equity securities inventory of hedge funds

Risk Economics®: Technical oversight of systematic empirical analysis conducted in connection with SB-217 pattern and practice investigation conducted by Colorado Attorney General of Aurora Police and Fire Rescue. Technical oversight of forensic financial analysis of complex structuring and intercreditor financing arrangements for an insurance industry regulatory investigation of a Ponzi scheme involving a Cayman Islands reinsurer and a hedge fund; Contingent liability analysis of LNG volumetric prepaid forwards; Subject matter expert assignment regarding rating agency securitization policies and practices; Evaluated the feasibility of two HUD agency sponsored municipal mortgage collateralized debt obligations (CDOs)

Clinton Group: Managed the structuring and placement of liabilities of $2.5 billion of investment-grade synthetic and funded asset-backed CDOs, as well as the development of two scalable derivative product investment and financing facilities

AIG: Evaluated M&A, structured private equity and structured credit proposals; managed the quantitative analytical team and structuring process for diverse structured transactions related to medium term note structures linked to commodity indices and hedge fund returns, commercial mortgage-backed interest-only financings, and asset-backed commercial paper financing conduits; managed the valuation of Algorithmics based upon technical review of the company's valuation, risk modeling, and asset-liability management technology

Fitch: Led structural development and document review, model audit/validation, hazard function/damage model assessment, and statistical/econometric analysis for insurance-linked securities/insurance and weather derivatives, esoteric commercial asset-backed securities (synthetic leases, operating company securitizations, etc.), structured credit derivatives and structured equity-, credit-, commodity-, mortgage/interest rate- and hedge fund- linked notes, multi-issuer medium-term note vehicles; comparative analysis of reduced-form versus structural credit models; rating transition/credit migration models; refinement of cash-flow volatility based default estimation model

APPENDIX II – SELECTED TECHNICAL/FINANCIAL ENGINEERING ASSIGNMENTS (CONT'D)

McDonald's Corporation USA: Co-developed a proprietary statistical benchmarking model for forecasting the performance of 900 McDonald's/WalMart joint-venture locations. The development of the model was commissioned by the Chief Operating Officer of McDonald's USA

Credit Suisse First Boston: Developed the *S*tructured *M*ulti-tranche *E*nhanced *L*oan *T*erm *S*ecuritization (*SMELTS*) first emerging market corporate collateralized loan obligation; conducted econometric analysis of high yield bond yields; researched structured finance applications of credit derivatives

Bank of Montreal/Harris Bank: Conducted extensive statistical analysis of risk-based performance for proprietary trend-following currency trading program and optimization of position management overlay

NYU Salomon Center: Research for "Financial System Design for Formerly Planned Economies"

WestLB: Operational risk/liability analysis and cashflow modeling for non-recourse highly leveraged transactions (HLTs)

Den Norske Creditbank: Operational risk/liability analysis and cashflow modeling for non-recourse project financings

Emanuel & Company: Caribbean cross-border debt/equity swap, LBO/leveraged recapitalization, leveraged lease

APPENDIX III – RELEVANT TOPICS REVIEWED AS EDITOR OF *JOURNAL OF RISK FINANCE*

- Stochastic Default Rate Models and Factor-Based Contingent Claims Analysis of Risky Debt
- Computing Risk Aversion Parameters and the Optimal Hedge Ratio/Capital Reserve Policy for Corporations Based upon Cash Flow Volatility
- Risk Capital Allocation for Pension Funds as a Function of Correlation Estimates, Risk Aversion, and Tail Probabilities
- Testing the Impact of Leverage and Volatility on Terminal Wealth for Index Investment Strategies
- Computing Risk-Adjusted Return on Capital (RAROC) for Property-Casualty Insurers
- Relative Risk-Adjusted Value Analysis for Catastrophic Risk Instruments
- Commercial Paper Default Estimation and Credit Rating Transitions
- Reduced Form Interest Rate Models
- Valuation of Dual-Triggered Contingent Contracts Based Upon Reservation Pricing of Residual Variance
- Role of Weather Derivatives as Power Market Hedging Contracts
- Applications of Extreme Value Theory to Risk Management Employing Hill (1975) Estimation
- Generalized Pareto Distribution Approximations of Operational Risk
- Factor Estimation of Conditional Credit Exposure
- Insurance Hedges Based Upon Linear Combinations of Reinsurance Indemnity and Index Contracts
- Estimating Portfolio Basis Risk of Insurance Industry Loss Warranty Contracts
- Comparative Analysis of Actuarial versus Financing Pricing of Insurance
- Value at Risk (VaR) Estimation
- Quadratic Approximations for Calculating VaR
- Liquidity Risk Estimation Applied to Risk-Based Capital Allocation
- Extreme Price Variation Method of Computing Risk-Based Capital
- Asset Allocation Applications of Variance Gamma Processes
- Leveraged Dynamic Hedging Policies
- Estimating Failure/Ruin Probabilities for Financial Institutions

APPENDIX III – RELEVANT TOPICS REVIEWED AS EDITOR OF JOURNAL OF RISK FINANCE

- Applications of Multinomial Distribution Functions and Probit Regression to Factor Models of Correlated Credit Risks
- Applying Conditional VaR to Pension Fund Asset-Liability Management
- Design and Pricing of Equity-Linked Life Insurance Under Stochastic Interest Rates
- Utility of Wealth and Coherent Risk Measures for Risk-Based Capital Allocation
- Static Hedging of Installment Premium Options
- Monte Carlo Simulation of Incremental VaR Properties
- Market Valuation of Insurance Contracts with Profit Sharing Features
- Pricing Insurance-Linked Securities Under Interest Rate Uncertainty
- Assessment of Liquidity Risk in the Pricing of Swaps with Default Risk
- Dimension Reduction in Computing VaR and Incremental VaR
- Simulation of Static versus Dynamic Hedging of Exotic Options
- Decision and Game Theoretic Techniques for Modeling Terrorism Risk
- Multivariate and Semivariance approaches to VaR
- Constant Elasticity of Variance and Variance Gamma Models for Barrier Option Valuation
- Seasonal Single-Factor Stochastic Weather Derivative Models
- Simulated Prepayment Bounds for Match Funding Prepayable Assets with Callable Liabilities
- Merton Model Parametric Credit Risk Disaggregation
- Properties of Stochastic Volatility Processes
- Employing L- Estimators to Calculate Quantile Based Risk Measures
- Extreme Value Theory Approaches to Fat Tails, Scaling, and Stable Laws
- Copula Approach to Valuing Options Exposed to Counterparty Default Risk
- Quantile-Fitting Approach to VaR for Options

APPENDIX IV – HIGHLIGHTS OF PROFESSIONAL EXPERIENCE: 1983-2008

- From 1983 through 1990, I was engaged in credit analysis across a wide range of industries including financial institutions. During 1991 through 1993, I served as a consultant to Mutual Benefit Life on various financial matters, to Bank of Montreal/Harris Bank on the statistical analysis of its currency trading models, and also participated in research on the structure of the Eastern European banking system being conducted by the Salomon Center at NYU Stern Graduate School of Business. During 1995, as a consultant with Credit Suisse First Boston (CSFB), developed structured products in collaboration with professionals at Credit Suisse Financial Products.

- From April 1997 through September 1998, as a Director within the Commercial Asset-Backed Group at Fitch IBCA, Inc. ("Fitch"), I was responsible for rating $50 Billion of structured note programs, linked to diverse reference portfolios and indices, including municipal bonds and hedge funds, as well as asset repackaging transactions which included benefit responsive wraps. While at Fitch, in addition to leading the structured notes rating program, I also led the insurance derivatives, insurance-linked securities, and catastrophe bond rating programs, as well as any insurance structures within esoteric asset-backed securities.

- From October 1998 through July 2001, as Vice President of Financial Engineering/Principal Finance for American International Group, Inc. ("AIG"), I was engaged in a wide range of structured insurance transactions, including structured finite insurance and financial reinsurance to provide collateral enhancement to support ratings of both Medium-Term Note ("MTN") programs and Structured Investment Vehicles ("SIVs"). I worked on diverse corporate assignments with senior management, including the pre-acquisition analysis of specialty insurer Hartford Steam Boiler, and the preliminary valuation of American General that led to its subsequent acquisition for $26 Billion, as well as participating in the $1 Billion private equity investment in General Atlantic Partners.

APPENDIX IV – HIGHLIGHTS OF PROFESSIONAL EXPERIENCE: 1983-2008 (CONT'D)

- While at AIG, I was recruited to join the Clinton Group, a large fixed income arbitrage and multi-strategy hedge fund management firm, as Managing Director for Structured Products. During my tenure at Clinton Group which lasted until my departure in April 2003, I was responsible for $5 Billion of CDO assets under management, and I evaluated diverse ABS, CMBS, CDO and SIV liabilities as collateral for Clinton Group managed CDOs. Development of SIV liabilities SIV structures. Subsequent to Clinton Group, developed term financing facilities for hedge fund investment portfolios employing similar models as those capital models employed for rating and managing SIVs and derivative product companies.

- Subsequent to my tenure at Clinton Group, I advised on development of hedge fund financing facilities, and served at Swiss Re, first from February through August 2007 as Senior Advisor to Roger W. Ferguson (the former Vice Chairman of the Federal Reserve), Head of Financial Services, until his April 2008 departure from Swiss Re to become the CEO of TIAA-CREF, and then from September 2007 through December 2008, as Managing Director of Relative-Value Market Strategies, reporting to the Swiss Re Executive Committee on development of comprehensive, enterprise-wide and market-consistent valuation frameworks and strategies related to hedging demographic, socioeconomic, and longevity/mortality exposure, as well as environmental and geo-political risks, underlying the life, health, casualty, and pension liabilities. I was technical advisor/subject matter expert for the formation of the Life and Longevity Markets Association (LLMA), loss index vendor PERILS AG and risk retention group Terra Firma.

- I have been an active member of the International Association of Financial Engineers (IAFE) Advisory Board. I was also the founding Co-Chair of the IAFE Liquidity Risk Committee and a member of the Steering Committee of the IAFE Investor Risk Working Group. I have been a participant in the Institutional Investment Management Committee of the NYMEX, the National Bureau for Economic Research, and the Wharton Financial Institutions Center Working Group, where I was involved in discussions regarding the role of timely and robust funding and operating procedures for highly leveraged institutions and leveraged investment vehicles. In a similar capacity, I have chaired and participated in conferences organized by the Federal Reserve banks of New York, Atlanta, and Richmond, on liquidity and systemic risk.

- I have also been a guest lecturer on these topics at Columbia University, New York University (Courant Institute of Mathematical Sciences), as well as speaker at the CFTC Commodity Pool Roundtable about hedge fund related market risks and at the Shadow Regulatory Committee on systemic risk implications related to hedge funds, OTC derivatives, structured products, and structured investment vehicles. I also contributed to the development of hedge fund valuation guidelines by the Standing Committee-5 of the International Organization of Securities Commissions (IOSCO), and participated in high-level discussions on systemic risk within financial markets at the invitation of the National Academy of Sciences and the World Economic Forum, as well as on systemic risk and National Security at the invitation of the Office of the Directorate of National Security.

- Furthermore, as the founding Editor-in-Chief of *The Journal of Risk Finance* (a quarterly peer-reviewed periodical which addresses topics in financial risk intermediation), and as a senior member of this journal's advisory board, as well as a member of the editorial advisory board for the *Journal of Alternative Investments*, I reviewed articles on risk management, derivatives and structured products.

APPENDIX V – ACADEMIC ACTIVITIES

ACADEMIC RESEARCH INTERESTS

Statistical interpretability of machine testimony and machine behavior; Statistical and forensic analysis of scientific evidence; Forensic economic and statistical analysis of fault detection/diagnostics applied to representation, warranty, indemnity and product liability; Economic analysis of data and algorithmic bias, collusion and predation liability risk; Artificial Intelligence/Machine Learning validation testing and verifiability analysis; Digital/signal forensics, technology and software liability; Operational risk and cyberphysical risk liability; Reliability engineering for cyber security and safety risk of industrial controls and distributed autonomous systems.

Law and economics of financial institutions and markets; Computational economics, market externalities, and the economics of systemic risk; Supply-Chain disruption, contingent business interruption and political risk/trade credit disputes; M&A/reorganization, successor liability and fraudulent conveyance in the context of the contingent liabilities and Workouts, Bankruptcy and Financial Distress; Risk-shifting and principal-agent problems in financial markets/firms and in technology adoption; Legal, regulatory, and policy implications for forensic valuation of complex contingent instruments; Common pool resources and natural resource economics; Population and consumption dynamics and application of spatio-temporal mapping and modeling to risk analysis and monitoring/surveillance; Empirical analysis of evolving demographics, consumption dynamics, and socioeconomic conditions for geo-political risks; Population demographics and valuation of contingent liabilities in financial markets; Environmental finance; Economics of epidemiology and environmental toxicology.

ACADEMIC TEACHING EXPERIENCE/INTERESTS

General teaching interests include: statistical signal processing and process control applied to remote and compressed sensing, anomaly detection, forensic analytics; governance, legal, regulatory, and economic policy implications of complex contingent instrument valuation for financial intermediaries and capital markets; applications of data analytics/machine learning to forward pricing of environmental and geo-political risks; applications of dynamic computational statistical models to socio-technical economic and geo-political systems.

PhD Dissertation Committees

- Zhu Wang *Virtual Reality for Human Balance Assessment* (May 2021)
- Sebastian Herscher *Scaling Multi-User Virtual and Augmented Reality* (January 2020)
- Connor DeFanti *Co-Located Augmented and Virtual Reality Systems* (May 2019)

Academic Teaching/Advising

- University of Chicago Booth School of Business Adjunct Professor of Econometrics & Statistics (2022-)
- NYU Center for Urban Science and Progress (CUSP) Capstone Project Team Co-Advisor: *Behavior Modeling Using Multi-Modal Mobility Data* (2022), *Developing Autonomous Drone Swarms with Multi-Agent Reinforcement Learning for Scalable Post-Disaster Damage Assessment* (2021); *Applying Multi-Agent RL to SLAM with Graph Pose for Sampled-Data MPC and CPN of Autonomous Drone Swarms* (2020)
- Faculty Independent Study Research Co-Advisor: Mayukh Ghosh, *Active Object Tracking with a Drone for Stationary Targets* (2022)
- Faculty Independent Graduate Study Research Advisor: John Y. Shin, Physics-inspired Machine Learning Algorithms and application of spectral graph theory, statistical physics, non-asymptotic random matrix theory, and computational learning theory to Graph Neural Networks (GNNs), heavy-tailed weight matrix compression and localization, as well as Jacobian matrix tail properties (Winter 2021); Mengheng Xue, Blind Source Separation (BSS) of non-intrusive electricity load monitoring (Spring 2019)
- Primary Senior Technical Oversight Advisor to RiskEcon® Lab Team Research Activities (2012-)
- NYU Tandon Cybersecurity Awareness Week (CSAW) Applied Research Competition, Judge (2012, 2017-2019)

Academic Teaching/Advising (Cont'd)

- NYU Tandon CSAW HackML Competition Judge 2019
- NYU Law School Patent Litigation Simulation 3L/LLM Course, Invited Guest Expert (Fall 2016, Spring 2019)
- Co-Advisor (with Dr. A. Michael Spence): Senior honors thesis by Stern Undergraduate Do Heon Koo, *The Supercharger Effect: Comparison of Hybrid, Plug-In Hybrid, and Battery Electric Vehicle Adoption in New York State* (2017)
- NYU Center for Data Science (NYUCDS), Capstone Project Team Co-Advisor: Preliminary Exploration of Natural Language-Oriented Topical Recommendation System for Financial Research and News (2018)
- NYU Center for Data Science (NYUCDS), Adjunct Professor; Capstone Course Director, M.Sc. Data Science, 2014-2015 (See Course Syllabus: https://cds.nyu.edu/wp-content/uploads/2014/09/syllabus-1.pdf)
- NYU Courant Institute of Mathematical Sciences, Lecturer, Advanced Topics in Applied Math: *Dynamic Computational Statistics Models for Socioeconomic & Geopolitical Systems*, 2012
- NYU Courant Institute of Mathematical Sciences, M.Sc. Program in Financial Mathematics; Guest Lecturer 2005, 2006, 2010; Fellow, 2011-Present
- Baruch University, Valuation and Financial Engineering Course, Guest Lecturer, 2009
- Columbia University GSB, Introduction to Derivatives Markets, Guest Lecturer, 2007
- Columbia University SIPA, Guest Lecturer 2005 *Mark-to-Model versus Mark-to-Market: Liquidity, Correlation, and the Pricing of Structured CDS Trades*
- Drew University, Wall Street Semester (Undergraduate), Guest Lecturer, 2005
- University of Chicago, Graham School, Continuing/Executive Education, 1995-1996
- Nyack College ADCP, Continuing/Executive Education, 1991-1993

APPENDIX VI – HIGHLIGHTS OF BOARD LEADERSHIP EXPERIENCE

I currently serve, or have previously served, on the boards of the following not-for-profit organizations: New York Academy of Sciences Board of Governors (2016-Present); Black Rock Forest Consortium Leadership Council (2013-Present); Hudson Highlands Land Trust Board of Directors (2007-2016); Scenic Hudson (2009-2015); Clearwater (2008); Hudsonia (2008).

Appendix B
Materials Reviewed
As of October 30, 2023

Case Documents

Indictment, United States District Court, Southern District of New York, United States of America v. Avraham Eisenberg

Bates Stamped Documents

DOJ_00000001-011
DOJ_00000061
DOJ_00000063-064
DOJ_00000066-068
DOJ_00000070
FTX_MANGO_SDNY_000000001-198

FTX Documents

0x00bcbbf4ff452abb495d75320c2d24422db258f4 (1).csv
0x27ed37b22c4e863c53b471c718731a43c882db867eddb62698ce50cb2b550edc.csv
297GaUYv6vGfyZZXrYz1zPd1E9LsAp1kXxU4Gy67sHFrSVHCnLFrB6AGrXSQ4ScjXQ3yUJejFvpBUhNM9AXP7Ftk.csv
2p86oBt6jV5QAFzWWCChSbNfd8rdNo3ZggzYS1uytTe1KJCemjMhmZ4qVasuu6FdcYz12PnK7WnyQXEyt74gFUyG.csv
4aPwYv5fKGKnQXiwjJii3cFsfvxqTbdaSWMXejNKD15s4y7p5A1k1PycWQetodTgPPgXHk7ji9vW5JCFB3PwBiYM.csv
admin_counterparties.csv
Findings for Mango Market Provided TX Hashes - FTX.pdf
main_balances.csv
main_deposits.csv
main_trades.csv
main_withdrawals.csv
Picture1.pdf
Picture2.pdf
sq2VX7WkNXVWhn9EHLrZWhyV6TKG31hMGrAAGjuG4EnNfSk27SwPTm4bBktvd4jP2w7hsfi4xpauyCAKjNovTCV.csv
trades_mngo_usd_all_2022-10-11.xlsx
vs_1Lk3bfBNKMaEUVK29YCDfzQE_face.pdf
vs_1Lk3bfBNKMaEUVK29YCDfzQE_front.pdf

AscendEx Documents

20221011-MNGO-Fill-History (1).xlsx
Declaration of custodian of records executed.pdf
KYT-U3679790238-TransfersExport-2022-11-21-21_59_26.xlsx
Mango trading on AscendEX - user identities.xlsx
MNGO_data_10142023_v2.xlsx
MNGO_trades_data.xlsx
MNGO_trades_data_fixed.xlsx
u3679790238 - depositwithdrawal record.xlsx
U3679790238 - TRANSACTION HSITORY.xlsx
U3679790238 - User Balance - AscendEX.pdf
U3679790238 - User Information Search - AscendEX.pdf
U3679790238 - User Wallet Search - AscendEX.pdf
U3679790238.xlsx

Academic Articles

Rostek, Marzena, and Marek Weretka, "Thin markets," The New Palgrave Dictionary of Economics (2008): 1-5.
Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam, "Order imbalance, liquidity, and market returns," Journal of Financial economics 65.1 (2002): 111-130.

Additional case production and materials as may be provided to me

Joel DeCapua

PROFESSIONAL EXPERIENCE

FEDERAL BUREAU OF INVESTIGATION

Special Agent, Cyber Crimes – New York, NY, October 2014 – January 2018, August 2022 – Present

- Led investigations into sophisticated network intrusions and technology enabled federal crimes.
- Subject matter expert in digital forensics, cyber investigations, and network security.
- Cyber Action Team (CAT) Operator

Supervisory Special Agent, Cyber Division – New York, NY, January 2018 – August 2022

- Support and manage various FBI network intrusion investigations.
- Guide policy, provide expert technical assistance to investigators, assess the performance of FBI cyber programs, initiate new investigations, and provide investigative resources to case teams.

Special Agent, White Collar Crimes – Newark, NJ, January 2010 – October 2014

- Investigated and enforced federal laws related to securities fraud and public corruption.

New Agent Trainee, FBI Academy – Quantico, VA, August 2009 – January 2010

Key Achievements:

Director's Award, Financial Crimes Enforcement Network, 2019
Exceptional Service Award, Federal Bureau of Investigation, 2017
Investigator of the Year Award, Federal Law Enforcement Foundation, 2016

STATE OF INDIANA

Financial Investigator – Indianapolis, IN, August 2004 – August 2009

- Led investigations into securities fraud and money laundering matters.

CERTIFICATIONS, TRAINING, AND PROFESSIONAL AFFILIATIONS

General Cybersecurity:

March 2018 - GIAC Continuous Monitoring Certification (GMON) (Inactive)
March 2015 - GIAC Security Essential Certification (GSEC)

Disk/Memory Forensics:

October 2018 - GIAC Reverse Engineering Malware (GREM) (Inactive)
August 2017 - GIAC Advanced Smartphone Forensics (GASF) (Inactive)
March 2017 - FBI CART Certified Digital Extraction Technician (DexT)
October 2016 - GIAC Certified Forensic Analyst (GCFA) (Inactive)
February 2016 - GIAC Certified Incident Handler (GCIH) (Inactive)
July 2015 - GIAC Certified Forensic Examiner (GCFE) (Inactive)

Network Forensics/Hacking:

July 2022 - GIAC Cyber Threat Intelligence (GCTI)
January 2022 - GIAC Cloud Penetration Tester (GCPN)
August 2020 - GIAC Web Application Penetration Tester (GWAPT)
July 2019 - GIAC Penetration Tester (GPEN)
March 2017 - GIAC Network Forensic Analyst (GNFA) (Inactive)
June 2016 - GIAC Certified Intrusion Analyst (GCIA) (Inactive)

Financial/Fraud Detection:

January 2009 - Certified Public Accountant (CPA) (Expired)
March 2008 - Certified Fraud Examiner (CFE) (Inactive)

EDUCATION

Indiana University, Kelley School of Business, MS Accounting, January 2007, Bloomington, IN
DePauw University, BA Economics, May 2004, Greencastle, IN

EXHIBIT 2

Waymaker LLP
515 S. Flower Street, Suite 3500
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T 424.652.7800

February 26, 2024

Brian E. Klein
Direct (424) 652-7814
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Via E-Mail

AUSA Thomas Burnett
AUSA Peter Davis
AUSA Tian Huang
United States Attorney's Office
Southern District of New York
1 Saint Andrews Plaza
New York, New York 10007

Re: *United States v. Avraham Eisenberg*, 23 Cr. 10 (AS)

Dear Counsel:

This letter is respectfully submitted to supplement defendant Avraham Eisenberg's previous expert witness disclosure served on the government on January 12, 2024. The purpose of this disclosure is to clarify Dr. Montgomery's opinions that "the price of MNGO [P]erpetuals at the time of defendant's alleged trading on October 11, 2022 was not artificial," and that because the market for MNGO is thin/illiquid, "the current trading price may not accurately reflect a fundamental value." This supplemental disclosure is made out of an abundance of caution and is not in any way a concession that the January 12, 2024 disclosure was inadequate. This disclosure is also made without the benefit of hearing the trial testimony and all the relevant information contemplated by Federal Rule of Criminal Procedure 16 and 18 U.S.C. § 3500.

Mr. Eisenberg explicitly reserves the right to further amend and/or supplement this disclosure based upon, among other things, the receipt of documents and other evidence from the government or third-parties, counsel's ongoing review of the recent government discovery productions, trial preparation, disclosures about anticipated witness testimony (including the government's own designated expert(s)), and ultimately the evidence (testimonial or opinion) offered in the government's case-in-chief.

John Montgomery, PhD

- Dr. Montgomery may also provide background testimony on the topic of fundamental value, which is a widely used term in financial economics. The fundamental value of a financial instrument means the value of cash flows (such as dividends or interest) that the instrument may provide. This value can reflect the risk or uncertainty of those cash flows, any time lags in realizing such cash flows (*i.e.*, discounts for the time value of

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money), and any contingencies or options embodied in the financial instrument. Dr. Montgomery may opine that MNGO does not have a fundamental value because no cash flows are attached to MNGO. Dr. Montgomery's testimony on this topic will be based on his extensive academic background in economics, his research and experience in financial markets, and his review of documents related to Mango Markets, as well as relevant portions of the government's discovery produced as of the date of this notice.

- Dr. Montgomery may opine that when an asset does not have a fundamental value, its value can only be the market-driven price, meaning its value is purely driven by the interplay of supply and demand. As such, because the asset's value is always a reflection of the interplay of supply and demand, price movement that is the result of the natural interplay of supply and demand on the open market, absent wash trades, is not artificial. This scenario applies to the market for MNGO, the MNGO/USDC Pair, and the MNGO Perpetuals. Specifically, because any given price of MNGO resulting from open market supply and demand cannot be artificial, the price of MNGO at the time of the defendant's alleged trading on October 11, 2022 was not artificial. Since the price of the MNGO Perpetuals is based on the value of MNGO, Dr. Montgomery may opine that at the time of the defendant's alleged trading on October 11, 2022 the price of the MNGO Perpetuals was not artificial. Dr. Montgomery's testimony on this topic will be based on his expertise as a financial economist, his experience analyzing financial markets trading, and on his review of documents related to Mango Markets, as well as relevant portions of the government's discovery produced as of the date of this notice.

- Dr. Montgomery may also testify about the government's experts' characterization of the market for MNGO as "thin." A thin market, as referred to by Dr. Mordecai, is "a market with *de minimus* and/or intermittent order flow."[1] When a market is thin, it is vulnerable to large price swings, particularly when a sizeable transaction is made. Dr. Montgomery may further testify that the market for MNGO was thin. Dr. Montgomery may opine that because it was thin, the market for MNGO was vulnerable to large price swings. However, large price swings on October 11, 2022 do not mean that the defendant's alleged trading caused an artificial price. Because MNGO does not have a fundamental value, every price of MNGO resulting from open-market trades is a market-driven price. Dr. Montgomery's testimony on this topic will be based on his research and experience in financial markets, his review of the government's expert disclosures for Kapil Jain and Dr. David Mordecai, his review of documents related to Mango Markets, as well as relevant portions of the government's discovery produced as of the date of this notice.

[1] Expert Disclosure of Dr. David K.A. Mordecai – United States v. Avraham Eisenberg, at 3 n.1.

WAYMAKER

Approval and Signature

I approve the disclosure of my qualifications, anticipated opinions, and bases for such opinions, as set forth above.

DocuSigned by:
John Montgomery
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2/26/2024

John Montgomery

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As always, we are available to discuss the above or any other aspect of the case.

Very truly yours,

Brian E. Klein
Ashley E. Martabano
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Waymaker LLP

-and-

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Attorneys for Avraham Eisenberg